

REMARKS

Claims 1-7 are pending in the present application. As acknowledged by the Examiner, claims 8-19 were withdrawn in a Response to a Restriction Requirement dated October 8, 2009. See Office Action, p. 2.

Claims 1 and 4-7 were rejected under 35 U.S.C § 103(a) as being unpatentable over either Asada (U.S. Patent No. 6,158,141) or Kamikawa (U.S. Patent No. 6,045,624) in view of either Mullee (U.S. Patent No. 6,871,656) or Nam (U.S. Patent No. 5,855,077). Claim 2 was rejected under 35 U.S.C § 103(a) as being unpatentable over either Asada or Kamikawa, in view of either Mullee or Nam, and further in view of Kamikawa (U.S. Patent No. 5,369,891). Claim 3 was rejected under 35 U.S.C § 103(a) as being unpatentable over either Asada or Kamikawa, in view of either Mullee or Nam, and further in view of either Goldman (U.S. Patent No. 3,277,907) or Jaeger (U.S. Patent No. 3,777,571).

With entry of this amendment, Applicants amend claims 1 and 5-7 and cancel claim 4. Reconsideration and reexamination of the pending claims in light of the amendments and the following remarks are respectfully requested.

Rejection Under 35 U.S.C. § 103(a)

Claims 1 and 4-7 were rejected under 35 U.S.C § 103(a) as being unpatentable over either Asada or Kamikawa '624 in view of either Mullee or Nam.

Claim 1

The present invention as recited in claim 1 is directed to, *inter alia*, a drying unit in a substrate processing system. Conventional substrate processing systems include a processing tank located below a drying unit. Wafers are first subjected to a chemical and rinsing process in the processing tank before being raised into the drying unit. This configuration, however, allows a chemical atmosphere from the processing tank to flow upward into the drying unit and adhere to the

surface of the wafer. This adhesion produces a watermark on the surface of the wafer that prevents the formation of a normal film and, consequently, deteriorates the wafer's electrical characteristics.

The substrate processing system recited in claim 1 resolves these problems. This system includes a processing tank, a drying unit, a carrying mechanism, a processing gas supply line, inert gas supply lines, a first discharge line, a second discharge line, and a controller.

The processing tank processes the substrates with a processing liquid.

The drying unit possesses openings connected to the outside atmosphere. A controller may set the drying unit in either an open or closed state by opening or closing these openings. In the closed state, the interior of the drying unit is isolated from the outside atmosphere. In the open state, currents of clean air are formed in the drying unit from the openings connected to the outside atmosphere by operating a first and second discharge lines. That is, the openings allow clean air to flow through the unit and out of the discharge lines. These currents of clean air prevent the chemical atmosphere from the processing tank from flowing upward into the drying unit.

Applicants have amended claim 1 to clarify that the drying unit includes openings connected to the outside atmosphere. In addition, Applicants have added recitations directed to the drying unit's open or closed state; the controller; and the formation of currents of clean air in the drying unit in the open state. Support for these amendments can be found in at least paragraphs [0050] – [0051] of the published application. Accordingly, Applicants have cancelled claim 4.

Amended claim 1 recites:

A substrate processing system comprising:
a processing tank for processing substrates with a processing liquid;
a drying unit including openings connected to the outside atmosphere,
disposed above the processing tank;
a carrying mechanism for carrying the substrates between the processing
tank and the drying unit;
a processing gas supply line for supplying a processing gas into the drying
unit;
inert gas supply lines for supplying an inert gas into the drying unit;

a first discharge line for discharging an atmosphere purged from the drying unit; and
a second discharge line for forcibly exhausting the drying unit[.].
wherein the drying unit is constructed such that the drying unit can be set in an open state in which the drying unit opens into the outside atmosphere by opening the openings and in a closed state in which the interior of the drying unit is isolated from the outside atmosphere by closing the openings, and
a controller sets the drying unit selectively in either of the open state in which the drying unit opens into the outside atmosphere and the closed state in which the interior of the drying unit is isolated from the outside atmosphere, and
wherein in the open state of the drying unit, currents of clean air are formed in the drying unit from the openings connected to the outside atmosphere to the first and second discharge lines by operating the first and second discharge lines.

In rejecting claim 1, the Examiner cited Asada, Kamikawa '624, Mullee, and Nam. Applicants respectfully submit that none of these references discloses at least the following drying unit recitations:

a drying unit including openings connected to the outside atmosphere, disposed above the processing tank;
...
wherein the drying unit is constructed such that the drying unit can be set in an open state in which the drying unit opens into the outside atmosphere by opening the openings and in a closed state in which the interior of the drying unit is isolated from the outside atmosphere by closing the openings, and
a controller sets the drying unit selectively in either of the open state in which the drying unit opens into the outside atmosphere and the closed state in which the interior of the drying unit is isolated from the outside atmosphere, and
wherein in the open state of the drying unit, currents of clean air are formed in the drying unit from the openings connected to the outside atmosphere to the first and second discharge lines by operating the first and second discharge lines.

Each of these references is discussed below.

Asada Fails To Disclose The Drying Unit Recitations

Asada is directed to an apparatus that dries semiconductor substrates by blowing isopropyl alcohol (IPA) and nitrogen gas onto the substrate after a rinsing process. Drying takes place in drying chamber 2. *See* Asada, Fig. 10. Top cover 12 may be opened or closed to allow wafers to be moved in and out of the drying chamber. *See id.* at col. 12, lines 62-65. Assuming, *arguendo*, that opening the top cover places the drying unit in the recited open state, Asada does not disclose at least that “currents of clean air are formed in the drying unit from the openings connected to the outside atmosphere to the first and second discharge lines by operating the first and second discharge lines.” Indeed, when top lid 12 is opened, Asada merely mentions that the wafer is moved in or out. *See id.* at col. 13, lines 34-37; col. 14, lines 8-10. Once the wafer passes through, top lid 12 is closed. During the short time that the lid is open, there is no teaching nor suggestion that the recited currents of clean air are formed.

Kamikawa '624 Fails To Disclose The Drying Unit Recitations

Kamikawa '624 is directed to a cleaning apparatus and drying chamber that prevent the formation of water marks on a wafer's surface. Like Asada's drying unit, Kamikawa's drying chamber possesses a lid 63 that opens and closes to allow wafers to move in and out. *See* Kamikawa '642, Fig. 7; col. 10, lines 6-7.

The flowchart in Figure 13 illustrates the operation of the cleaning apparatus. Steps 1201 and 1202 indicate that lid 53 is opened to allow wafers to be lowered into the drying chamber. *See id.* at Fig. 13. Once the wafers are delivered, lid 53 is closed in step 1203. *See id.* This lid remains closed until step 1215 when it is opened to remove the wafers from the drying chamber. *See id.*

Assuming, *arguendo*, that opening the lid corresponds to the recited open state, Kamikawa '642 does not disclose at least that “currents of clean air are formed in the drying unit from the openings connected to the outside atmosphere to the first and second discharge lines by operating the first and second discharge lines.” Like Asada, Kamikawa '624 merely mentions that the wafer is moved in or out when lid 63 is opened. *See id.* at col. 11, line 65 – col. 12, line 4. No other acts

occur during this open state. *See id.* As such, Kamikawa '624 fails to disclose the recited currents of clean air.

Mullee Fails To Disclose The Drying Unit Recitations

Mullee is directed to an apparatus that removes photoresist and photoresist residue from a semiconductor wafer. This removal process exposes the wafer to supercritical carbon dioxide and a stripper chemical in a pressure chamber. Once the photoresist or the photoresist residue is removed from the wafer, the pressure chamber is flushed and vented.

Notably, this removal process does not involve a drying chamber. Indeed, Mullee neither teaches nor suggests the use of a drying chamber. Rather, Mullee's supposed relevance is limited to specific features such as a discharge line. *See* Office Action, p. 3. In view of this deficiency, Mullee fails to disclose the drying unit recitations.

Nam Fails To Disclose The Drying Unit Recitations

Nam is directed to a wafer drying apparatus with two separate chambers for drying wafers. Performing the drying process in two chambers prevents the generation of contaminative particles on the wafers. The first chamber generates IPA vapor. The second chamber uses the IPA vapor from the first chamber to dry the wafer. The second chamber possesses a cap 41 that opens and closes to allow the wafer to move in and out of the second chamber. *See* Nam, col. 4, lines 12-15; Fig. 2.

Assuming, *arguendo*, that opening the cap corresponds to the recited open state, Nam does not disclose at least that "currents of clean air are formed in the drying unit from the openings connected to the outside atmosphere to the first and second discharge lines by operating the first and second discharge lines." Like Kamikawa '624, Nam merely mentions that the wafer is moved in or out when cap 41 is opened. *See id.* at col. 11, line 65 – col. 12, line 4. No other acts occur during this open state. *See id.* As such, Nam fails to disclose the recited currents of clean air.

Because none of these references discloses a “drying unit including openings connected to the outside atmosphere ... wherein the drying unit ... can be set in an open state in which the drying unit opens into the outside atmosphere by opening the openings and in a closed state in which the interior of the drying unit is isolated from the outside atmosphere by closing the openings; a controller sets the drying unit selectively in either of the open state in which the drying unit opens into the outside atmosphere and the closed state in which the interior of the drying unit is isolated from the outside atmosphere; and wherein the open state of the drying unit, currents of clean air are formed in the drying unit from the openings connected to the outside atmosphere to the first and second discharge lines by operating the first and second discharge lines[,]” Applicants respectfully request that the Examiner withdraw this rejection.

Claims 4-7

Applicants have canceled claim 4. As such, the rejection for this claim is rendered moot.

Applicants have amended claims 5-7 to depend from claim 1. As such, claims 5-7 are patentable over Asada, Kamikawa '624, Mullee, and Nam for at least the foregoing reasons with respect to claim 1.

Claim 2 was rejected under 35 U.S.C § 103(a) as being unpatentable over either Asada or Kamikawa '624, in view of either Mullee or Nam, and further in view of Kamikawa '891.

Claim 2

Claim 2 depends from claim 1. As such, claim 2 is patentable over Asada, Kamikawa '624, Mullee, and Nam for at least the foregoing reasons with respect to claim 1.

Kamikawa '891 fails to overcome the deficiencies of Asada, Kamikawa '624, Mullee, and Nam. Kamikawa '891 is directed to an apparatus that dries wet semiconductor wafers. Figure 2 illustrates that this drying apparatus has a top lid 28 with opening 32 in which a filter 34 is arranged. *See* Kamikawa '624, Fig. 2; col. 3, lines 26-27. Gas supply source 36 supplies dry air or dry nitrogen gas into the drying apparatus through filter 34. *See id.* at col. 3, lines 28-30.

Applicants respectfully submit that Kamikawa '891 fails to disclose at least “wherein in the open state of the drying unit, currents of clean air are formed in the drying unit from the openings connected to the outside atmosphere to the first and second discharge lines by operating the first and second discharge lines.” Before the washing and drying processes begin, the disclosed apparatus first opens top lid 28 to load the wafers into the apparatus. *See id.* at col. 5, lines 5-8. Kamikawa fails to disclose that “currents of clean air” are formed by operating any discharge lines in this open state.

Because Kamikawa '891 fails to disclose a “drying unit including openings connected to the outside atmosphere ... wherein the drying unit ... can be set in an open state in which the drying unit opens into the outside atmosphere by opening the openings and in a closed state in which the interior of the drying unit is isolated from the outside atmosphere by closing the openings; a controller sets the drying unit selectively in either of the open state in which the drying unit opens into the outside atmosphere and the closed state in which the interior of the drying unit is isolated from the outside atmosphere; and wherein the open state of the drying unit, currents of clean air are formed in the drying unit from the openings connected to the outside atmosphere to the first and second discharge lines by operating the first and second discharge lines[.]” Kamikawa '891 fails to cure the deficiencies of Asada, Kamikawa '624, Mullee, and Nam. As such, claim 2 is patentable over either Asada or Kamikawa '624, in view of either Mullee or Nam, and further in view of Kamikawa '891.

Claim 3 was rejected under 35 U.S.C § 103(a) as being unpatentable over either Asada or Kamikawa '624, in view of either Mullee or Nam, and further in view of either Goldman or Jaeger.

Claim 3

Claim 3 depends from claim 1. As such, claim 3 is patentable over Asada, Kamikawa '624, Mullee, and Nam for at least the foregoing reasons with respect to claim 1. Neither Goldman nor Jaeger overcomes the deficiencies of Asada, Kamikawa '624, Mullee, and Nam.

Goldman is directed to an animal cage washer. This washer is designed to use less water, heat, and detergent than conventional washer systems. At the end of a wash period, the washer opens a drain valve to drain the water to a sewer by a pump. *See* Goldman, col. 6, lines 50-52. Applicants respectfully submit that this drain valve does not correspond to the recited drying unit as there is no teaching nor suggestion that “currents of clean air” are formed in the drain valve as required by claim 1. Rather, Goldman’s supposed relevance is limited to specific features such as a discharge line. *See* Office Action, p. 8.

Jaeger is directed to a collecting device that gathers exhaled air for later measurement of exhaled gaseous materials. The collecting device is comprised of, *inter alia*, an inner container connected to an inflatable bag and an extraction pipe. *See* Jaeger, col. 1, lines 43-50. Jaeger neither teaches nor suggests the use of a drying unit as required by claim 1. Like Goldman, Jaeger’s supposed relevance is limited to specific features such as a discharge line. *See* Office Action, p. 8.

In addition to the above deficiencies, Applicants respectfully submit that Goldman and Jaeger are nonanalogous art. MPEP § 2141.01(a)(I) provides that “[i]n order to rely on a reference as a basis for rejection ... the reference must either be in the field of applicant’s endeavor or, if not, then be reasonably pertinent to the particular problem with which the inventor was concerned.” A reference is “reasonably pertinent” if it is “relevant to the particular problem with which the inventor is involved.” *See* MPEP § 2141.01(a)(I) (citing *State Contracting & Eng’g Corp. v. Condotte America, Inc.*, 346 F.3d 1057, 1069 (Fed. Cir. 2003)).

Here, neither Goldman’s animal cage washer nor Jaeger’s exhaled air collecting vessel is related to a system for substrate processing. As such neither reference is in Applicants’ field of endeavor. Moreover, neither reference is relevant to preventing the formation of watermarks on semiconductor wafers. Indeed, Goldman and Jaeger neither teach nor suggest the use of their apparatuses with wafers. Consequently, these references are not “reasonably pertinent” to the problem with which Applicants’ invention is concerned.

In view of these differences, Goldman and Jaeger fail to cure the deficiencies of Asada, Kamikawa '624, Mullee, and Nam. Consequently, claim 3 is patentable over either Asada or Kamikawa '624, in view of either Mullee or Nam, and further in view of either Goldman or Jaeger.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue. If it is determined that a telephone conference would expedite the prosecution of this application, the Examiner is invited to telephone the undersigned at the number given below.

In the unlikely event that the transmittal form is separated from this document and the Patent Office determines that an extension and/or other relief is required, Applicants petition for any required relief including extensions of time and authorize the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952** referencing **199372005800**. However, the Commissioner is not authorized to charge the cost of the issue fee to the Deposit Account.

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Respectfully submitted,

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